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Specification and Drawings, as originally filed, with Application for Patent Serial No: **2,407,464**, on October 10, 2002, by **CANIMEX INC.**, assignee of Patrick Barriault, François Beaudoin and Danny Roy, for "Hydraulic Governor Device for Use with a Rotational Shaft".

L Régimbal

Agent certificateur/Certifying Officer

January 12, 2004

Date

Canada

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04-09-02

OPIC CIPO

HYDRAULIC GOVERNOR DEVICE FOR USE WITH A ROTATIONAL SHAFT

Field of the invention:

The present invention relates to a governor device. More particularly, the present invention relates to an hydraulic governor device for use with a rotational shaft, such as the overhead shaft of garage doors, mini-warehouse doors, commercial rolling steel doors and the like, for example, the device being used to controllably govern the rotation of the shaft operatively actuated by a torque resulting from a given force. For example, the device may be used to controllably govern the rotation of an overhead shaft of a garage door operatively connected to a driving mechanism or a counterbalancing mechanism in the event of a failure of said mechanism so as to prevent the garage door from falling uncontrollably to the ground due to the weight of the door or move up uncontrollably due to an excessive upward counterbalancing force.

Background of the invention:

It is known in the art that several engineering problems are related in one way or another to the simple requirement of governing or slowing a weight of any kind. These problems occur when there is a need to control the speed of the weight which is deprived of a driving (or "counterbalancing") mechanism. Generally, such a situation occurs when the driving mechanism is not designed to control the speed in both direction or when there is an emergency or failure of the mechanism. Sometimes, driving mechanisms are not totally fail safe by design.

It is also known in the art that a fail safe mechanism or device is going to react in such a manner that, in a case of emergency or internal failure, the weight is going to move to a safe position at a controlled rate. Several mechanisms or devices are actually devised to brake and/or stop the weight they are meant to move, at the last known position before failure of the mechanism. Such a behavior is not acceptable for many devices and mechanisms because a weight several feet above ground is still subject to fall if the link of the device or mechanism fails, and, if it is the case, there is nothing to stop or control the falling of the weight.

Also known in the art are many other problems which are related in the design of a governing mechanism that is totally fail safe, examples of which are the following: the limited space available to implement the governing device; the need of feedback mechanisms to adjust the speed rate; the constant torque given by braking device; the lack of mechanism that are giving high torque in function of the speed rate; the lack of easy and real-time adjustment in governing device; and the relative high cost of such devices. Each of these problems taken separately is relatively easy to overcome. However, the challenge essentially lies is resolving these different aspects with a single integrated system.

US patent No. 4,432,254 granted to SCHULTZ on February 21st, 1984, relates to a viscous damper having rigid plastic structure. This viscous damper which has any one or more of three main features, namely at least one of a rotor and housing being formed from rigid plastic material, a bearing projection on one housing portion extending from the plane of the housing working surface less than shear film spaced relation toward the working surface of the rotor member, and means for closing a filler opening through the housing comprising a sealing disk engaging on a shoulder across the opening and a retainer pressing the disk onto the shoulder and having radial retaining teeth, retainingly engaging a wall about the opening.

A problem associated with this type of viscous damper is the fact that it is not adjustable in real-time and it is not autonomous or disc-brake controlled by an electronic device with a feedback system to produce a governor-like behavior. Furthermore, another problem associated with this type of viscous damper is the fact that it requires an external source of power and is more complex than other governor devices.

Hence, in light of the aforementioned, there is a need for an improved governor which, by virtue of its design and components, would be able to overcome some of the aforementioned problems.

Summary of the invention:

The object of the present invention is to provide a governor device which satisfies some of the above-mentioned needs and which is thus an improvement over the governor devices known in the prior art.

In accordance with the present invention, the above object is achieved, as will be easily understood, with a governor device such as the one briefly described herein and such as the one exemplified in the accompanying drawings.

According to another aspect of the invention, there is also provided a driving (or "counterbalancing") mechanism provided with the above-mentioned governor device.

According to yet another aspect of the invention, there is also provided the garage door provided with the above-mentioned driving (or "counterbalancing") mechanism.

The objects, advantages and other features of the present invention will become more apparent upon reading of the following non-restrictive description of a preferred embodiment thereof, given for the purpose of exemplification only with reference to the accompanying drawings.

Brief description of the drawings:

Figure 1 is a perspective view of a rotational shaft operatively connected to a driving mechanism, the rotational shaft being provided with a governor device according to the present invention.

Figure 2 is an exploded view of the components of the governor device shown in Figure 1.

Figure 3 is a cross-sectional of the governor device shown in Figure 1.

Figure 4 is a perspective view of some of the components of the governor device of Figure 2, these components being shown in an assembled configuration.

Figure 5 is another cross-sectional view of the governor device shown in Figure 1.

Figure 6 is a schematic diagram of the governor device according to the present invention.

Detailed description of a preferred embodiment of the invention:

In the following description, the same numerical references refer to similar elements. The embodiments shown in the figures are preferred.

Moreover, although the present invention was primarily designed for use with rotational shafts (or "overhead shafts") of garage doors and the like, it may be used with other rotational shafts and in other fields, as apparent to a person skilled in the art. For this reason, expressions such as "garage", "overhead", "shaft", etc. used herein should not be taken as to limit the scope of the present invention and includes all other kinds of doors or items with which the present invention could be used and may be useful. As will also be easily understood, the cross-sectional area of the shaft according to the present invention is not necessarily limited to a circular configuration, and may take on other suitable geometrical configurations, such a square, rectangular, triangular, etc., as apparent to a person skilled in the art.

Moreover, in the context of the present invention, the expressions "overhead shaft", "rotational shaft", and any other equivalent expression known in the art will be used interchangeably. Furthermore, the same applies for any other mutually equivalent expressions, such as "damper" and "governor", “driving" and counterbalancing", as well as "fluid", "liquid" and “hydraulic" for example, as also apparent to a person skilled in the art.

In addition, although the preferred embodiment of the present invention as illustrated in the accompanying drawings comprises various components and although the preferred embodiment of the governor device (1) as shown consists of certain geometrical configurations as explained and illustrated herein, not all of these components and geometries are essential to the invention and thus should not be taken in their restrictive sense, i.e. should not be taken as to limit the scope of the present invention. It is to be understood, as also apparent to a person skilled in the art, that other suitable components and cooperations thereinbetween, as well as other suitable geometrical configurations may be used for the governor device (1) and corresponding parts according to the present invention, as briefly explained herein, without departing from the scope of the invention.

Broadly described, the present invention relates to a governor device 1 for use with a rotational shaft, such as the overhead shaft of a garage door for example.

Referring now to Figure 1, there is shown a general view of the governor device (1) solidly mounted to a fixed structure (5), i.e. one that has no free degrees of freedom. The device (1) is operatively connected to a rotational shaft (6) that is controlling a vertical weight (2). A driving mechanism, such as chain hoist (3) may be used to move the weight upward and downward. If any problems occurs with the driving mechanism, (this excludes of course a failure or collapsing of the cable (4) holding the weight (2)), then the weight (2) is no more within the control of the chain hoist (3). A purpose of the governor device (1) according to the present invention is to regulate the falling speed of the weight (2) until it reaches the floor level in the event of a failure of the driving mechanism.

Figures 2 to 5 refer to a detailed description of the regulating mechanism. The input shaft (7) of the device (1) is preferably connected in rotation with the rotational shaft (6). The input shaft (7) has preferably 8 cams (23) that are inside a sleeve (21) and the caps (20). These 8 cams (23) are preferably in interference with 4 corresponding cams on pistons (22) in such a manner that with each turn of the input shaft (7)(23), the pistons (22) are doing a back and forth movement, preferably 4 times. This back and forth movement of the pistons (22) is possible because their rotation is preferably blocked by two posts on each of them that are preferably sliding into corresponding bushings (26) in the caps (20). Hence, a function of the cams on the pistons (22) and the input shaft (23) is to transform the rotation of the said input shaft (23) into translation for the pistons (22), either axially, radially or perpendicular to the axle of the input shaft (23), as apparent to a person skilled in the art. According to this particular embodiment, the translation is preferably parallel (axially) to the axle of the input shaft (23). In order to avoid locking problems and to minimized the friction in rotation due to axial load, there is a need to include appropriate bearings in the caps (22), as apparent to a person skilled in the art. These bearings are preferably placed between the input shaft (23) and the caps (22) to prevent the movement of the said input shaft (23).

The movement of the pistons (22) implies a movement of the fluid of the device (1) from one side of a piston (22) to the other side of the other piston (22) through a cavity (30) in the sleeve (21) and a valve (25). As can be easily understood, a restriction of the fluid in the valve (25) limits the flow rate, thus increases the pressure inside the device (1) and limits the speed of the translation movement of the pistons (22), and finally limits the rotational speed of the input shaft (7). In order to achieve this, the fluid must be preferably incompressible, such as hydraulic oil for example. Combined with this first effect, the limitation of the rotation of the input shaft (7) is preferably increased with the increasing speed of the fluid inside the device (1) by increasing the turbulence in the fluid on both side of the pistons (22).

The adjustment of this device (1) in terms of rotational speed of the input shaft is preferably obtained by turning the control valve (25) either clockwise or counter-clockwise. Preferably also, the adjustment range is fixed for a given embodiment and depends of the maximum flow rate and the minimum leakage between the pistons (22).

The device (1) is preferably a totally enclosed hydraulic device. Its construction is similar to that of a tie rod hydraulic cylinder used to imply translation with a pressurized fluid. Four tie rods (28) are preferably bolted to the caps (26) with nylon lock hexagonal nuts (29). Other type of fasteners and materials may be used, as apparent to a person skilled in the art.

The pistons (22) are preferably linked together with two piston guides (24) to maintain an equal volume of fluid on each side of the pistons (22). It is important to note that leakage between the pistons (22) is possible and permitted without affecting the device (1). An embodiment of this device (1) with high internal leakage is going to have a smaller range of adjustment, but is still going to be able to regulate the speed rate of a weight.

In the present embodiment, the raising of the weight (2) is also going to be regulate by the device (1) because there is nothing to disconnect or to deactivate it. According to the present invention, there may be means for connecting or disconnecting this device (1).

In the present embodiment, the acceleration rate is that of the gravity of the earth. The device (1) is preferably not sensitive to acceleration rate and direction. This means that the device (1) could be used to regulate the speed of a rotational shaft with an acceleration rate lower or higher than that of the gravity. Moreover, the direction of the acceleration of the weight does not affect the operation of the device. The way this invention is linked to the weight determines its effect on the weight. Hence, changing the acceleration rate or its direction will not affect the operation of the device, as apparent to a person skilled in the art.

In the present embodiment, the movement of the weight is vertical, from the top to the bottom and the device (1) is designed to work with a rotational shaft. This means that if the door is sliding horizontally with a given speed, this invention is going to regulate its speed and stop it at a given position.

Several modifications can be made to the above-mentioned governor device 1, without departing from the scope of the present invention.

As may now be appreciated, the present invention is a substantial improvement over the prior art in that by virtue of its design and components, the governor device 1 according to the present invention is a compact governor mechanism in a low cost form factor. The device(1) delivers a high torque with a small volume and dimensions without the need of any device reading or compiling the speed rate (feedback system) of the governed weight. In addition, the device is totally independent of any external energy source, thus providing a totally autonomous governor. Also, the device (1) is easy to adjust in real-time and is a fail safe component of any security system according to the definition given above. Moreover, the device can be used as a rolling fire door governor device for emergency speed controlled and quick test close-up system (with anti-backdrive) The present invention is also advantageous in that it is directed to any device using a rotational shaft to control its speed and/or position or the speed and/or position of its pay load. In particular, a device that is moving a weight through a rotational shaft that could go backward and accelerate to a high speed if not governed properly.

Of course, numerous modifications could be made to the above-described embodiments without departing from the scope of the invention as apparent to a person skilled in the art.

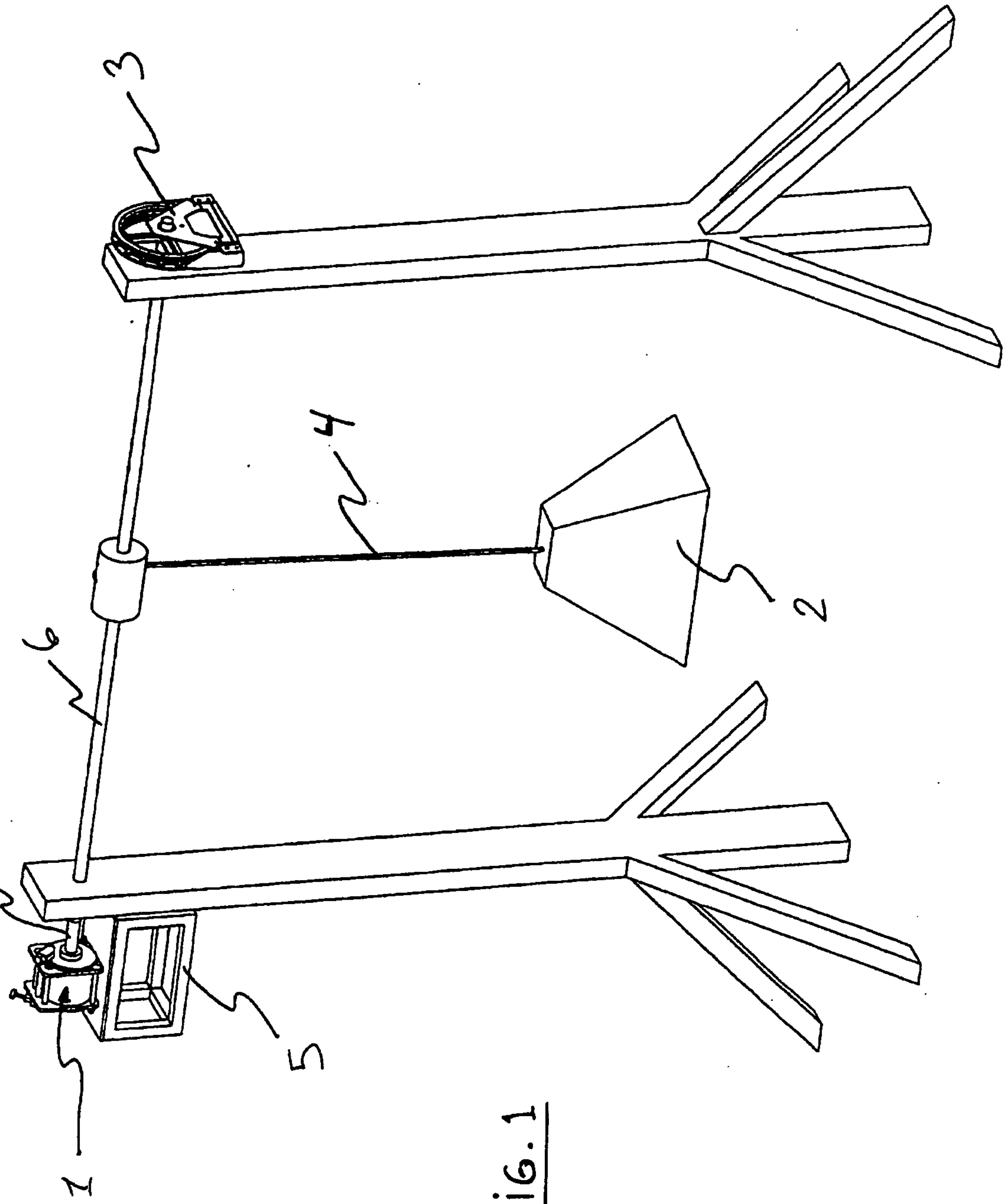

FIG. 1

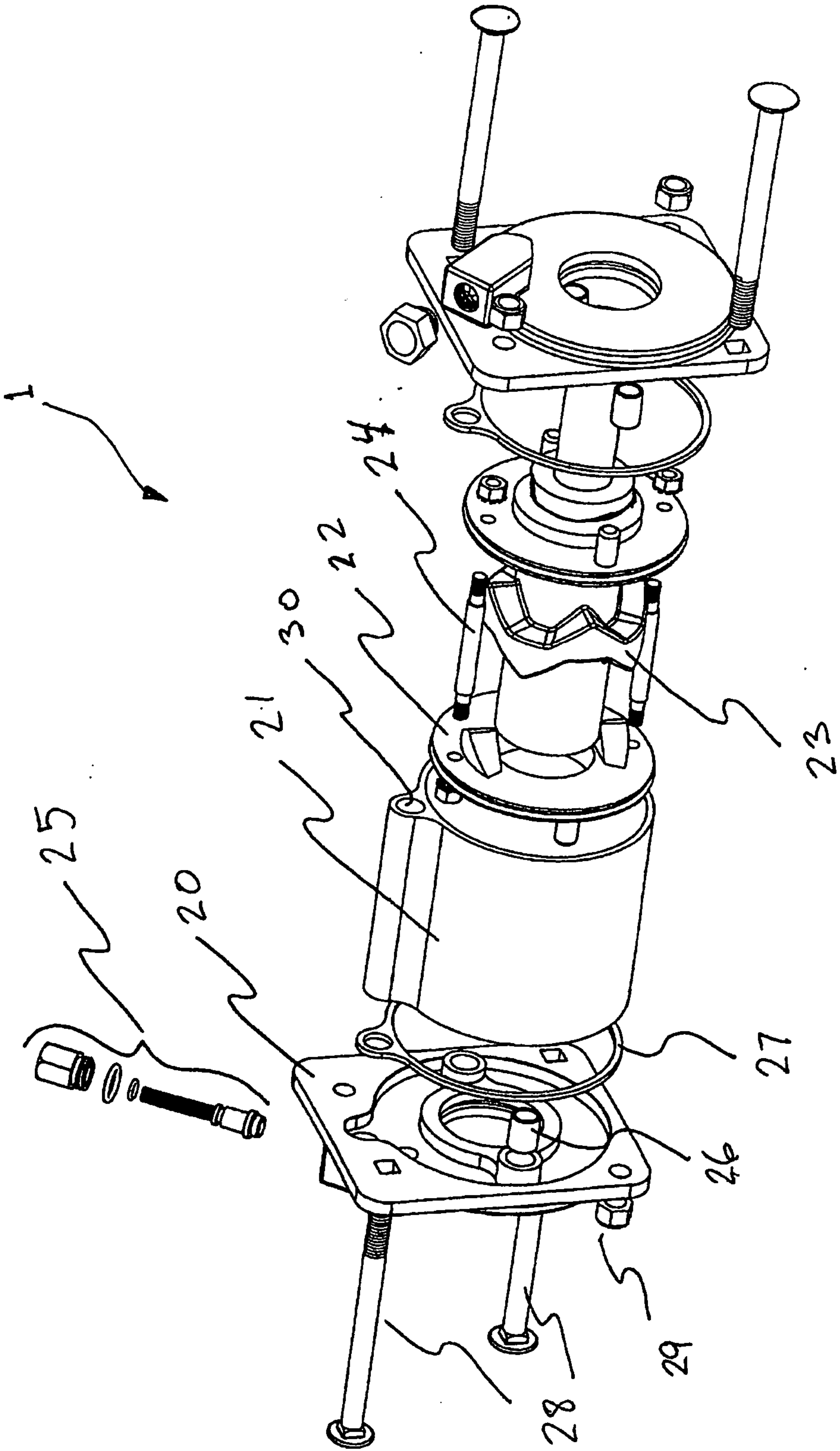

FIG.2

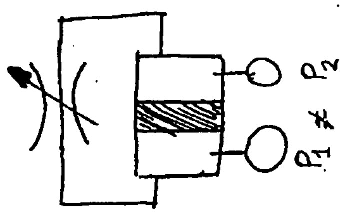

Fig-6

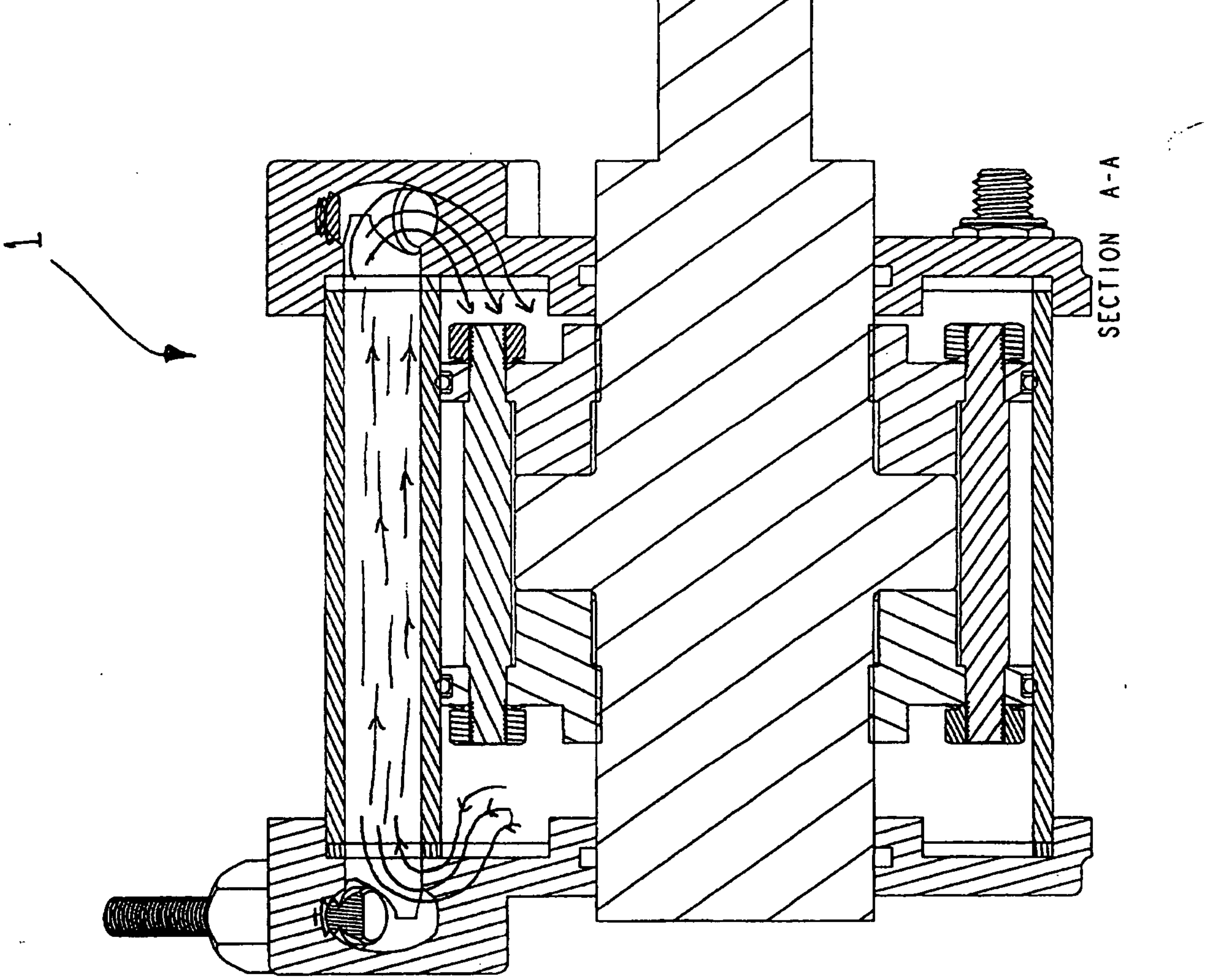

FiG.3

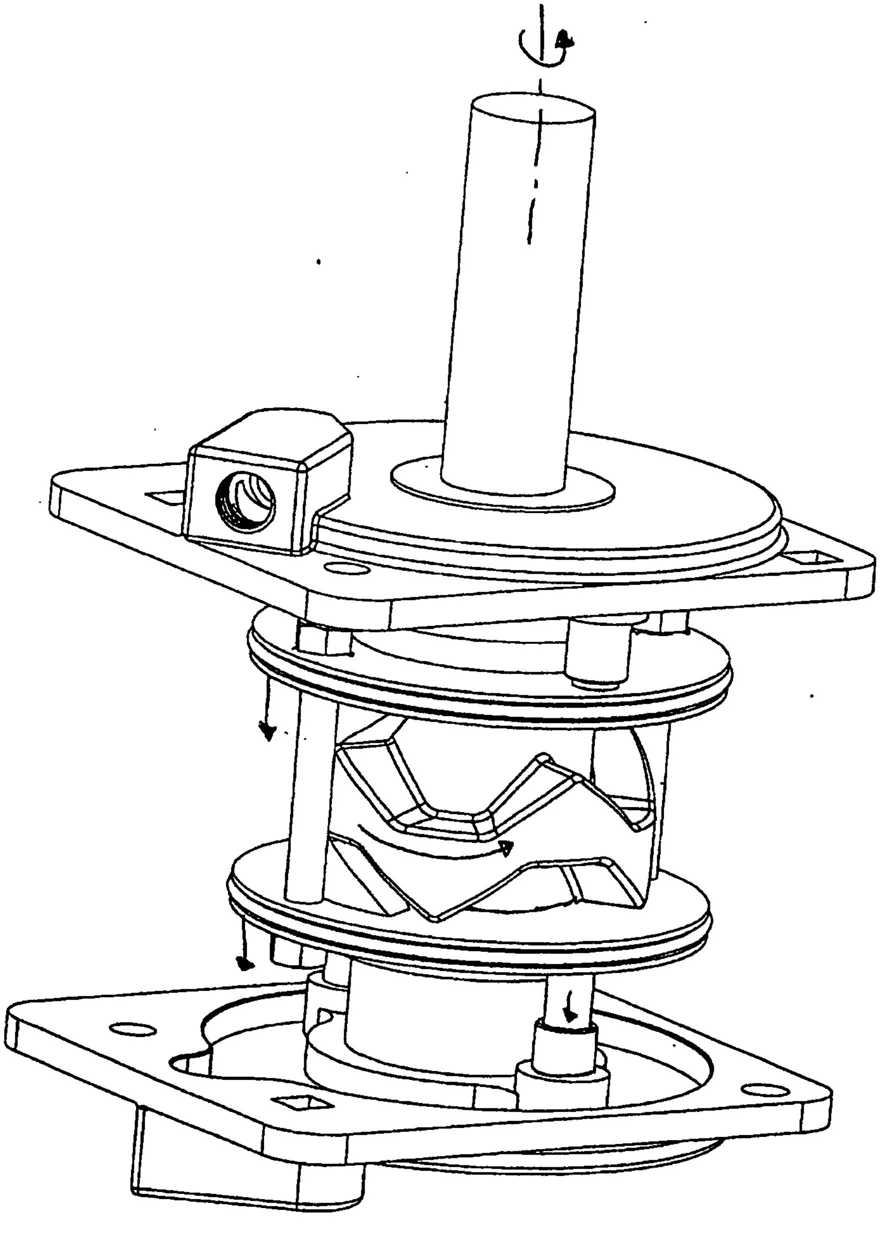

FIG. 4

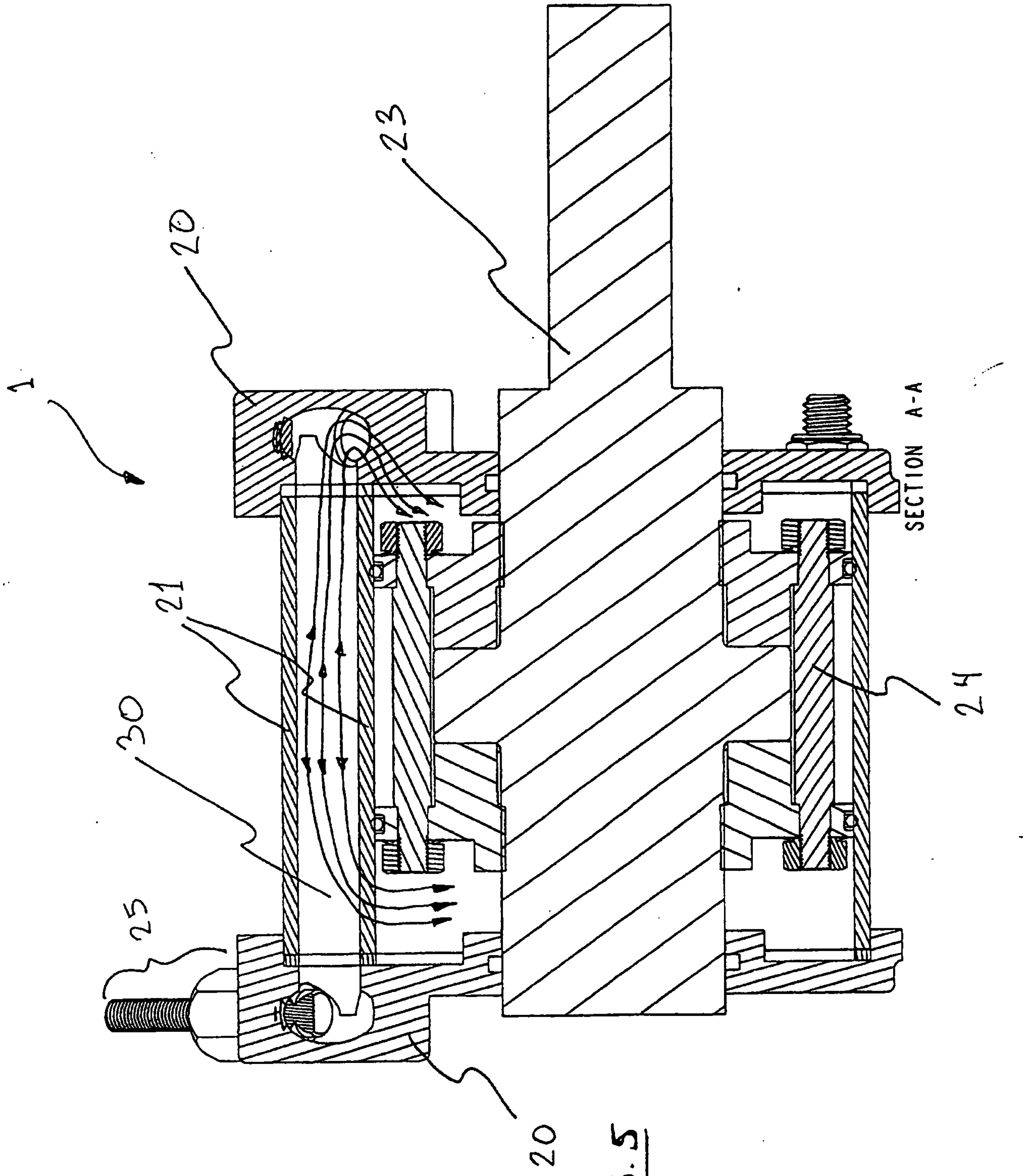

FIG.5